Practitioner's Docket No. 700355-052696-US ***PATENT***

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Joel E. WHITE et al.	Confirmation No.: 9053
Application No.:	10/535,748	Group No.: 1631
Filed:	09/27/2005	Examiner: SKOWRONEK, Karlheinz R.

For: ELECTRO-OPTICAL NUCLEIC ACID-BASED SENSOR ARRAY AND METHOD FOR DETECTING ANALYTES

DECLARATION BY DR. JOEL WHITE

I, Joel White, Ph.D., declare as follows:

1. I am a co-inventor of the above-identified patent application.

2. A true copy of my curriculum vitae are attached herewith.

3. I am an adjunct research assistant professor of neuroscience at the Department of Neuroscience, Tufts University Medical School, Boston, MA. I have been involved in study of olfactory systems for over two decades. I have also been actively developing vapor analysis systems based on olfactory system for over a decade.

4. I have been advised that the Examiner in the above-identified patent application has cited U.S. Patent No. 7,029,852 to Liebholtz ("Liebholtz").

5. I have been asked to describe the significant difference between our detection system and the detection system described by Liebholtz.

6. I have also been asked to describe why the fibrous and particulate support for the oligonucleotide probes in our system would not work in the system and apparatus of Liebholtz.

7. The system of Liebholtz is essentially a particle separator and collector with a sensor system within. Specifically, Liebholtz describes "functions of acquisition, filtering, sorting, selection, impingement on sensor surfaces and trapping of particles in a fluid in accordance with desired mathematical functions of size, density, shape and surface characteristics." (Col. 2, lines 52-56).

9. Liebholtz further describes that their object is to "provide a combination of mechanical, aerodynamic, and kinetic methods to concentrate and/or sort particles of desired size and/or density from a fluid (gaseous, vapor or liquid) for detection by a sensor." (Col. 2, lines 57-61).

10. Liebholtz also describes a "biosensor using aptamers, single-chain nucleic acids, double-chain nucleic acids, hybridized chemicals incorporated to these molecules, or combinations thereof for the detection of harmful agents." (Col. 3, lines 3-7).

11. Liebholtz describes the substrate as follows: "[i]n one embodiment, the bioreceptor is an aptamer on a suitable organic substrate, optionally protected by a barrier or filter that is porous to aerosols, particles and spores of a desired diameter and to gases dissolved in the in the atmosphere. Glass is a preferred substrate, although certain plastics may also be desirable due to the possibility allowing a greater number of active sensor molecule sites per unit area." (Col. 4, lines 3-10, emphasis added). Liebholtz also mentions that the substrate can be a decellularized biomembrane. (Col. 11, lines 53-54).

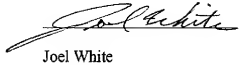
12. The detection system of the above-identified patent application is designed to rely on reaction nucleic acids to analytes in vapor phase (par [003]). The nucleic acids are not intended to bind particles like the nucleic acids of Liebholtz. Therefore a large surface area for detection is preferred (par. [095]). This can be achieved using fibrous or particulate support that have relatively open porous structure (pars. [095]-[097]).

13. Based on my knowledge of the sensing systems, such an open porous structure would not be suitable for collecting solid particles as is done by the system of Liebholtz. This is because particles would go through the structure and not be impinged on the surface of the structure.

14. Therefore, in my opinion, the "suitable organic structures" as described in Liebholtz would not include support materials with open porous structures, such as fibrous or particulate supports, for example, silk screen or fiberclass.

15. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, and that such willful false statements may jeopardize the validity of the application or any patent that issues therefrom.

10-16-07
Date



Joel White

Curriculum Vitae

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Degrees

1983: B.A. in Biology (Honors Program)
The University of Kansas
Lawrence, KS

1989: Ph.D. in Biology (Psychobiology and Neuroscience Program)
"The Functional Organization of the Elasmobranch Nervus Terminalis Ganglion: Anatomical and Electrophysiological Studies"
The Florida State University
Tallahassee, FL

Additional education

1978: Summer Course in Oceanology
Occidental College
Los Angeles, CA

1986: Short Course in "Basic Immunocytochemical Techniques"
Marine Biological Laboratory
Woods Hole, MA

Research and Professional Experience

1981–1983: Undergraduate Research Project, The University of Kansas

1983–1989: Graduate Research, The Florida State University

1990–1994: Postdoctoral Research, New England Medical Center

1994–1996: Research Associate, Department of Neuroscience
Tufts University School of Medicine

1996–2006: Research Assistant Professor, Department of Neuroscience
Tufts University School of Medicine

2002–2006: Executive Vice President, CogniScent, Inc.

2006–present: Adjunct Research Assistant Professor, Department of Neuroscience
Tufts University School of Medicine

2006–present: Vice President of Technology, CogniScent, Inc.

Teaching experience

1983–1984: Teaching Assistantship
Introductory Biology Laboratory
Plant and Animal General Process Biology Lecture
The Florida State University

1992–2006: Computers in the Biomedical Sciences -
Lectures in Introductory Programming and Computer Networks
Tufts University School of Medicine

1991–2006: Teaching Assistant in Medical Neuroscience Laboratory
Tufts University School of Medicine

1991–2006: Graduate Neuroscience -
Lectures in Somatosensory System and Motor Control
Tufts University School of Medicine

2003–2005: Course Organizer, Medical Neuroscience Laboratory
Tufts University School of Medicine

Honors

1983: Graduated with Highest Distinction
The University of Kansas

1984–1989: Psychobiology Fellowship
The Psychobiology and Neuroscience Program
The Florida State University

1986: Scholarship to attend "Basic Immunocytochemical Techniques"
at the Marine Biological Laboratory, Woods Hole, MA
The Grass Foundation, Inc.

1988: The Don Tucker Memorial Award for Graduate Student Presentation
The 10th Annual Meeting of the Association for Chemoreception Sciences

1989: The Margaret Menzel Award for Doctoral Student Progress
The Department of Biological Science
The Florida State University

Grants and Contracts

1982: Undergraduate Research Award (support for research)
University of Kansas

1983: Undergraduate Research Award (support for research)
University of Kansas

1984: Grant-in-Aid for "Studies on the Nervus Terminalis"
The Bryan W. Robinson Neurological Foundation, Inc.

Jan. 1991–Dec. 1993: NIH Postdoctoral Fellowship
National Institute on Deafness and Other Communication Disorders
"Dye imaging of the olfactory bulb in behavioral contexts"
Grant # 1 F32 DC 00053-01, Total costs: $81,200

Jan. 1995–Dec. 1997: NIH Small Grant Program (R03)
National Institute on Deafness and Other Communication Disorders
"Neuronal activity related to odorant chemical structure"
Grant # 1 R03 DC 02782-01, Total costs: $79,985

Mar. 1997–Mar. 2000: Co-PI, Program Project
Defense Advanced Research Projects Agency
"Principles of odor recognition by the olfactory system applied to detection of low concentration explosives"
Grant # 9636-A-065, Total costs: $440,172

Feb. 2003–Aug. 2003: PI, Phase I SBIR Contract
U.S. Army
"Development of an Explosive Detection System Based on Biological Principles"
Contract # DAAD17-03-C0-0069, Total Costs: $70,000

Jul. 2003–Feb. 2004: PI, Phase I SBIR Grant
National Science Foundation
"DNA-Based Chemosensors for Direct Detection of Volatile Compounds"
Grant # DMI-0319855, Total Costs: $100,000

Dec. 2003–Jun. 2004: Co-PI, Phase I SBIR Contract
U.S. Army
"Personnel Detection and Warning Systems for Perimeter, Ambush, and Casualty Detection"
Contract # W911NF-04-C-0029, Total Costs: $70,000

Feb. 2004–Feb. 2007: PI, Research Grant
Office of Naval Research
"Characterization of Mechanisms Underlying Vapor Phase Responses of DNA-Based Sensors"
Grant # N00014-04-1-0245, Total costs: $300,000

Apr. 2004–Oct. 2004: PI, Phase I SBIR Contract
Homeland Security Advanced Research Projects Agency
"Rapid Low Vapor Pressure Chemical Detection Using a Hand-held Artificial Nose"
Contract # NBCHC040049, Total costs: $100,000

Jan. 2005–Jun. 2005: PI, Research Contract
Homeland Security Advanced Research Projects Agency
"A Hand-held Artificial Nose-based Chemical Agent Detection System for First Responders"
HSARPA RA 03-01, TTA4 (pending negotiation), Total Costs: $409,665

Memberships

Association for Chemoreception Sciences

The International Society for Optical Engineering

Society for Neuroscience

Committees

1998–2000: Councilor, Executive Committee
Association for Chemoreception Sciences

1992–1998: Audio-Visual Coordinator for the Annual Meeting
Association for Chemoreception Sciences

1995: Chair of AChemS Online Committee
Association for Chemoreception Sciences

1987: Graduate Student Representative on Faculty Search Committee
The Florida State University

Patents

U.S. Patent # 6,649,416. Intelligent electro-optical sensor array and method for analyte detection. Inventors: John S. Kauer and Joel White. Issued Nov. 28, 2003.

U.S. Patent #7,062,385. Intelligent electro-optical nucleic acid-based sensor array and method for detecting volatile compounds in ambient air. Inventors: Joel White and John S. Kauer. Issued June 13, 2006.

Peer reviewed publications

White, J.E., W.J. Bell, and T.R. Tobin (1984). Local search in the housefly *Musca domestica* after feeding on sucrose. *J. Insect Physiol.* **30**:477–487.

White, J. and M. Meredith (1987). The nervus terminalis of the shark: the effect of efferent impulses on ganglion cell activity. *Brain Res.* **400**:159–164.

White, J., K.A. Hamilton, S.R. Neff, and J.S. Kauer (1992). Emergent properties of odor information coding in a representational model of the salamander olfactory bulb. *J. Neurosci.* **12**(5):1772–1780.

White, J. and M. Meredith (1993). Spectral analysis and modelling of ACh and NE effects on shark nervus terminalis activity. *Brain Res. Bull.* **31**:369–374.

White, J. and M. Meredith (1995). The nervus terminalis ganglion of the bonnethead shark (*Sphyrna tiburo*): evidence for cholinergic and catecholaminergic influence on two cell types distinguished by peptide immunocytochemistry. *J. Comp. Neurol.* **351**:385–403.

Dickinson, T.A., J. White, J.S. Kauer, and D.R. Walt (1996). A chemical-detecting system based on a cross-reactive optical sensor array. *Nature* **382**: 697–700.

White, J., J.S. Kauer, T.A. Dickinson, and D.R. Walt (1996). Rapid analyte recognition in a device based on optical sensors and the olfactory system. *Anal. Chem.* **68**:2191–2202.

Dorries, K.M., J. White, and J.S. Kauer (1997). Rapid classical conditioning of odor response in a physiological model for olfactory research, the tiger salamander. *Chem. Senses* **22**:277–286.

Dickinson, T.A., D.R. Walt, J. White, and J.S. Kauer (1997). Generating sensor diversity through combinatorial polymer synthesis. *Anal. Chem.* **69**:3413–3418.

Johnson, S.R., J.M. Sutter, H.L. Engelhardt, P.C. Jurs, J. White, J.S. Kauer, T.A. Dickinson, and D.R. Walt (1997). Identification of multiple analytes using an optical sensor array and pattern recognition neural networks. *Anal. Chem.* **69**:4641–4648.

Dickinson, T.A., J. White, J.S. Kauer, and D.R. Walt (1998). Current trends in 'artificial-nose' technology. *Trends Biotechnol.* **16**:250–258.

White, J., T.A. Dickinson, D.R. Walt, and J.S. Kauer (1998). An olfactory neuronal network for vapor recognition in an artificial nose. *Biol. Cybern.* **78**:245–251.

Alkasab, T.K., T.C. Bozza, T.A. Cleland, K.M. Dorries, T.C. Pearce, J. White, and J.S. Kauer (1999). Characterizing complex chemosensors: Information theoretic analysis of olfactory systems. *Trends Neurosci.* **22**:102–108.

Alkasab, T.K., J. White, and J.S. Kauer (2002). A computational system for simulating and analyzing arrays of biological and artificial chemical sensors. *Chem. Senses* **27**:261–275.

Proceedings and other non-reviewed publications

Meredith, M. and J. White (1987). Interactions between the olfactory system and the terminal nerve: electrophysiological evidence. *Ann. New York Acad. Sci.* **519**: 349–368.

White, J. and M. Meredith (1987). The nervus terminalis of the shark: influences on ganglion cell activity. *Ann. New York Acad. Sci.* **510**:703–706.

White, J. and M. Meredith (1987). Synaptic interactions in the nervus terminalis ganglion of elasmobranchs. *Ann. New York Acad. Sci.* **519**:33–49.

Kauer, J.S., J. White, D.P. Wellis, and A.R. Cinelli (1994). Properties of salamander olfactory bulb circuits. In K. Kurihara, N. Suzuki, and H. Ogawa (eds.): *Olfaction and Taste XI*. Springer-Verlag, Tokyo. pp. 433–439

White, J. and J.S. Kauer (1999). Odor recognition in an artificial nose by spatio-temporal processing using an olfactory neuronal network. *Neurocomputing* **26–27**:919–924.

White, J. and J.S. Kauer (2001). Exploring olfactory population coding using an artificial olfactory system. *Prog. Brain. Res.* **130**:191–203.

Kauer, J.S. and J. White (2001). Imaging and coding in the olfactory system. *Annu. Rev. Neurosci.* **24**:963–979.

White, J., S. Mall, and J.S. Kauer (2002). Using biology to guide development of an artificial olfactory system. In J. Ayers, J. Davis, and A. Rudolph (eds.): *Neurotechnology for Biomimetic Robots*. MIT Press, Cambridge, MA. pp. 97–113.

Kauer, J.S. and J. White (2003). Representation of odor information in the olfactory system: from biology to an artificial nose. In F.G. Barth, J.A.C. Humphrey, and T.W. Secomb (eds.): *Sensors and Sensing in Biology and Engineering*. Springer-Verlag, Wien. pp. 305–322.

White, J., L.P. Waggoner, and J.S. Kauer (2004). Explosives and landmine detection using an artificial olfactory system. In R.S. Harmon, J.T. Broach, J.H. Holloway, Jr. (eds): *Detection and Remediation Technologies for Mines and Minelike Targets IX, Proceedings of SPIE, Vol. 5415*. SPIE, Bellingham, WA. pp. 521–532.

Book chapter

Christensen, T.C. and J. White (2000). Representation of olfactory information in the brain. In: T.E. Finger, W.L. Silver, and D. Restrepo (eds). *Neurobiology of Taste and Smell, 2nd Edition*. John Wiley & Sons, Inc., New York, pp 201–232.

Abstracts

White, J. and M. Meredith (1985). Investigations of the nervus terminalis in elasmobranchs. *Chemical Senses* **10**(3):422.

White, J. and M. Meredith (1986). The nervus terminalis of the shark: influences on ganglion cell activity. *Chemical Senses* **11**(4):680.

White, J. and M. Meredith (1986). Interactions between the nervus terminalis and the olfactory system. *Soc. Neurosci.* **12**(2):1357, Abstr. #370.9.

White, J. and M. Meredith (1987). Intracellular recordings from ganglion cells of the elasmobranch nervus terminalis. *Chemical Senses* **12**(4):707.

White, J. and M. Meredith (1988). In vitro pharmacological studies on the elasmobranch nervus terminalis: evidence for cholinergic and catecholaminergic suppression of ganglion cell activity. *Chemical Senses* **13**(4):746.

White, J. and M. Meredith (1988). Cholinergic and catecholaminergic suppression of nervus terminalis ganglion cell activity in the elasmobranch. *Soc. Neurosci.* **14**(1):53, Abstr. #25.1.

White, J. (1989). Immunocytochemical and histochemical evidence for two neurotransmitter systems in the elasmobranch nervus terminalis ganglion. *Soc. Neurosci.* **15**(1):31, Abstr. #19.5.

White, J. and M. Meredith (1990). ACh and NE effects on elasmobranch nervus terminalis ganglion cells: Spectral analysis and computer modelling. *Chemical Senses* **15**(5):652.

White, J., S.N. Neff, A. Cinelli, and J.S. Kauer (1990). Modelling the salamander olfactory bulb: Single cell and network interactions. *Soc. Neurosci.* **16**(1):403, Abstr. #170.1.

White, J., S.N. Neff, A. Cinelli, and J.S. Kauer (1991). A large-scale computer model of the salamander olfactory bulb: Responses to simulated electrical and odor stimulation. *Chemical Senses* **16**(5):599.

White, J. and J.S. Kauer (1992). Imaging odor-evoked activity in the salamander olfactory epithelium (OE) and bulb (OB): Physiological correlates of behavioral observations. *Soc. Neurosci.* **18**(2):1200, Abstr. #502.7.

White, J. and J.S. Kauer (1993). Imaging the salamander peripheral olfactory system: Structure/activity relationships for two homologous odorant series. *Chemical Senses* **18**(5):649–650.

Kauer, J.S. and J. White (1993). Confocal imaging of voltage-sensitive dye signals from the salamander olfactory epithelium and bulb. *Soc. Neurosci.* **19**(1):118, Abstr. #53.5.

Dorries, K.M., J. White, and J.S. Kauer (1994). Classically conditioned skin potential changes as a behavioral measure of olfactory response in the tiger salamander. *Chemical Senses* **19**(5):463.

Dorries, K.M., J. White, and J.S. Kauer (1994). A behavioral method for measuring olfactory discrimination in the tiger salamander. *Soc. Neurosci.* **20**(1):331, Abstr. #144.9.

White, J., S. Fox, B. Laurijssens, B. Healey, G. Teehan, D. Walt, and J. Kauer (1994). An artificial chemosensory detection system based on biological principles of odor coding. *Soc. Neurosci.* **20**(1):330, Abstr. #144.8.

White, J., T.A. Dickinson, D.R. Walt, and J.S. Kauer (1996). Rapid odorant recognition in an artificial chemosensory device based on the olfactory system. *Chemical Senses* **21**(5):687.

White, J., N. Freedner, and J.S. Kauer (1996). Salamander olfactory bulb responses to a set of nine odorant stimuli. *Chemical Senses* **21**(5):687.

White, J., T.A. Dickinson, D.R. Walt, and J.S. Kauer (1996). Implementation of a new neural network architecture in an artificial chemosensory system. *Soc. Neurosci.* **22**(3):2020, Abstr. #793.9.

White, J., T.A. Dickinson, D.R. Walt, and J.S. Kauer (1997). Improved vapor recognition in an artificial nose by spatio-temporal processing using an olfactory analytical network. Presented at the 12th International Symposium on Olfaction and Taste. San Diego, CA, July 7–12.

White, J., T.A. Dickinson, D.R. Walt, and J.S. Kauer (1997). Rapid processing of temporal signals by an olfactory neuronal network in an artificial nose. *Soc. Neurosci.* **23**(2):1270, Abstr. #500.11.

White, J. (1998). Noise analysis of spatio-temporal information processing in a computer simulation of the olfactory bulb. *Chemical Senses* **23**:571–572.

Pearce, T.C., T.A. Dickinson, D.R. Walt, J. White, and J.S. Kauer (1998). Combining information across input afferent streams gives rise to hyperacuity in biological and artificial olfactory systems. *Chemical Senses* **23**:555.

Kauer, J.S. and J. White (1998). A portable artificial nose based on oflactory principles. *Soc. Neurosci.* **24**(1): 652, Abstr. #256.9.

Kauer, J.S., D.R. Walt and J. White (1999). A portable artificial nose based on multiple oflactory principles. *Chemical Senses* **24**:559.

Alkasab, T.K., J.S. Kauer, and J. White (1999). Techniques for quantifying information in olfactory sensor arrays. *Chemical Senses* **24**:559-560.

White, J., T.C. Bozza, and T.K. Alkasab (1999). Probability considerations in the study of olfactory receptor tuning. *Chemical Senses* **24**:592.

White, J. and J.S. Kauer (2000). Improved odorant discrimination in an artificial nose through feedback control of environmental sampling. *Chemical Senses* **25**:604.

White, J. and J.S. Kauer (2001). Sensor response kinetics as a basis for chemical recognition in an artificial olfactory system. *Chemical Senses* **26**:1044.

White, J., R.N. Ray, L.P. Waggoner, and J.S. Kauer (2002). Landmine detection using an artificial olfactory system. *Chemical Senses* **27**: A68–A69 (online at http://www.chemse.oupjournals.org).

White, J.E., L.B. Williams, M.S. AtKisson, and J.S. Kauer (2004). DNA-based fluorescent chemosensors for direct detection of volatile compounds in an artificial nose. 26th Annual Meeting of the Association for Chemoreception Science, April 21–25, Sarasota, FL. Abstract #125.

Kauer, J.S. and J.E. White (2004). Olfactory 'interferometry' - non-contiguous distributions of olfactory receptor neurons expressing one olfactory receptor. 26th Annual Meeting of the Association for Chemoreception Science, April 21–25, Sarasota, FL. Abstract #289.

Williams, L.B., J.S. Kauer, and J.E. White (2004). Characterization of the mechanism of odor sensing in novel DNA-based fluorescent sensors. 26th Annual Meeting of the Association for Chemoreception Science, April 21–25, Sarasota, FL. Abstract #365.

Invited presentations and seminars

2/2/87: "Synaptic Interactions in the Nervus Terminalis Ganglion of Elasmobranchs"
Presented at the New York Academy of Sciences Conference - The Terminal Nerve (Nervus Terminalis): Structure, Function and Evolution

8/7/88: "Investigating Neural Circuits in the Elasmobranch Nervus Terminalis Ganglion: Electrophysiology and Pharmacology"
Presented at the Lousiana Marine Consortium Conference - Chemoreception in Aquatic Organisms

1/31/92: Panel presentation at 25th annual Winter Conference on Brain Research

2/13/97: "Spatio-temporal Information Processing in an Artificial Olfactory System"
Seminar at MIT Sea Grant Program

7/12/97: "An Artificial Olfactory System Based on Optical Sensor Arrays and Temporal Coding"
Presented in the symposium "Odorant Encoding by Distributed Parallel Processing" at the 12th International Symposium on Olfaction and Taste

8/15/98: Invited discussant, "The future of electrode design and neural ensemble recording technology: Applications of real-time processing of neural ensemble data and development of neuromimetic devices"
NIMH Population Coding and Cell Assembly Meeting

12/4/98: "Odorant recognition from cross-reactive sensors: Exploring distributed specificity in an artificial olfactory system"
Presented in the workshop "Olfactory Coding: Myths, Models and Data" at the 12th Annual Conference on Neural Information Processing Systems

References

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Dr. Barbara R. Talamo
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